Digital Signal Processing in Decay Studies *

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The development of novel data acqusition system based on a digital processing of detector signals [1,2] will be presented. This system is based on Digital Gamma Finder (DGF) modules of XIA [3]. It was originally designed to study microsecond particle radioactivities at the Holifield Radioactive Ion Beam Facility (Oak Ridge). An observation of a fine structure in proton emission from a near-spherical nucleus, a 3-μs activity of ^{145}Tm [4,5], was among first results enabled by the digital signal processing.

However, the DGF-based data acqusition was applied already in a variety of nuclear spectroscopy experiments, aimed at nuclei on both sides of the beta stability valley. The first observations of an $I^{\pi}=8^{-}$ K-isomer in a drip-line nucleus ^{140}Dy [6], of a fine structure in proton emission from ^{141}Ho [7], and of two-proton ground-state radioactivity of ^{45}Fe [8] are among most recent examples. The applications related to the studies of neutron-rich nuclei include short-lived isomers produced in relativistic heavy-ion fragmentation [9], a β-γ-conversion electron spectroscopy of silver [10] and copper [11] isotopes, a separation of the components of "isobaric cocktail" radioactive beams [2] and, in a near future, a cold neutron beta decay [12].

Present limitations and possible future developments of the HRIBF digital signal processing system will be briefly discussed.

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